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PLEASE KEEP THIS

BOOK WITH TUBE TESTER



INSTRUMENTS

FOR RESEARCH AND DEVELOPMENT

INSTRUCTION MANUAL

for

MODEL 1230

CARDMATIC TUBE TESTER

THE HICKOK ELECTRICAL INSTRUMENT COMPANY • 10514 Dupont Avenue, Cleveland 8, Ohio



MODEL 1230
CARDMATIC TUBE TESTER

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STANDARD EIA GUARANTEE

The Hickok Electrical Instrument Company warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair such instruments which, under normal use and service, disclose the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing any instrument or test equipment which proves to be defective, when returned to us transportation prepaid, within 90 days from the date of original purchase, and provided the serial number has been made known to us promptly for our records.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability, or which have been subject to misuse, negligence, or accident, or which have had the serial number altered, effaced or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories, including all vacuum tubes not of our manufacture, used with this product are not covered by this warranty.

This warranty is in lieu of all other warranties expressed or implied, and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Parts will be made available for a minimum period of five years after the manufacture of this equipment has been discontinued. Parts include all materials, charts, instructions, diagrams, accessories, etc., which have been furnished in the standard model.

RETURNING EQUIPMENT FOR REPAIR

Before returning any equipment for service, under warranty or otherwise, the factory must first be contacted giving the nature of the trouble. Instructions will then be given for either correcting the trouble or returning the equipment. Upon authorization, this equipment should be forwarded directly to the Hickok factory address, 10636 Leuer Avenue, Cleveland, Ohio, or to a designated service station in your locality. All correspondence pertaining to repairs should be directed to the Hickok office address, 10514 Dupont Avenue, Cleveland 8, Ohio, or to the authorized service station designated.

REGISTRATION CARD

The above guarantee is contingent upon the attached registration card being returned to the factory immediately upon receipt of the equipment.

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THE HICKOK ELECTRICAL INSTRUMENT COMPANY
Cleveland, Ohio

DESCRIPTION:

The Model 1230 is an automatic, "Card Type", tube tester which combines speed, simplicity of operating, and a high degree of accuracy.

It consists of the following items:

- 1 Automatic "Card Type" tube tester
- 1 Set Operating Cards
- 1 Instruction Book
- 1 Set Special Test Cards

New circuitry, incorporated in the Model 1230, evaluates tubes directly for (1) Leakage and Shorts, (2) Quality, and (3) Gas. The results are indicated on a Good-Bad basis that leaves no doubt in the mind of the operator as to the condition of the tube.

Physically the Model 1230 is housed in an attractive case. Tube sockets, meter, short indicator, "On-Off", "Quality" and card switches are conveniently arranged on the top panel. Complete operating instructions are also attached to the top panel.

Removable panels on the right side and back allow access to the calibrating controls and power supply tubes. Calibration, adjustment and routine maintenance can be accomplished without removing the tester from the case.

INSTALLATION:

The following procedure should be observed before operating the instrument to determine that it is functioning properly in all respects.

1. Visually inspect the instrument for damage during shipment. All claims for shipping damage should be made immediately with the carrier.
2. Remove the back panel from the case. This is secured by eight Phillips head machine screws, (6-32 x 3/8)
3. Check that all tubes are securely held in their sockets. Refer to Figure #1.

IMPORTANT: Be sure that the 100 watt light bulb is screwed tightly into the socket in the lower right hand corner. If this lamp is loose or missing, no filament voltages will be supplied to tubes being tested.

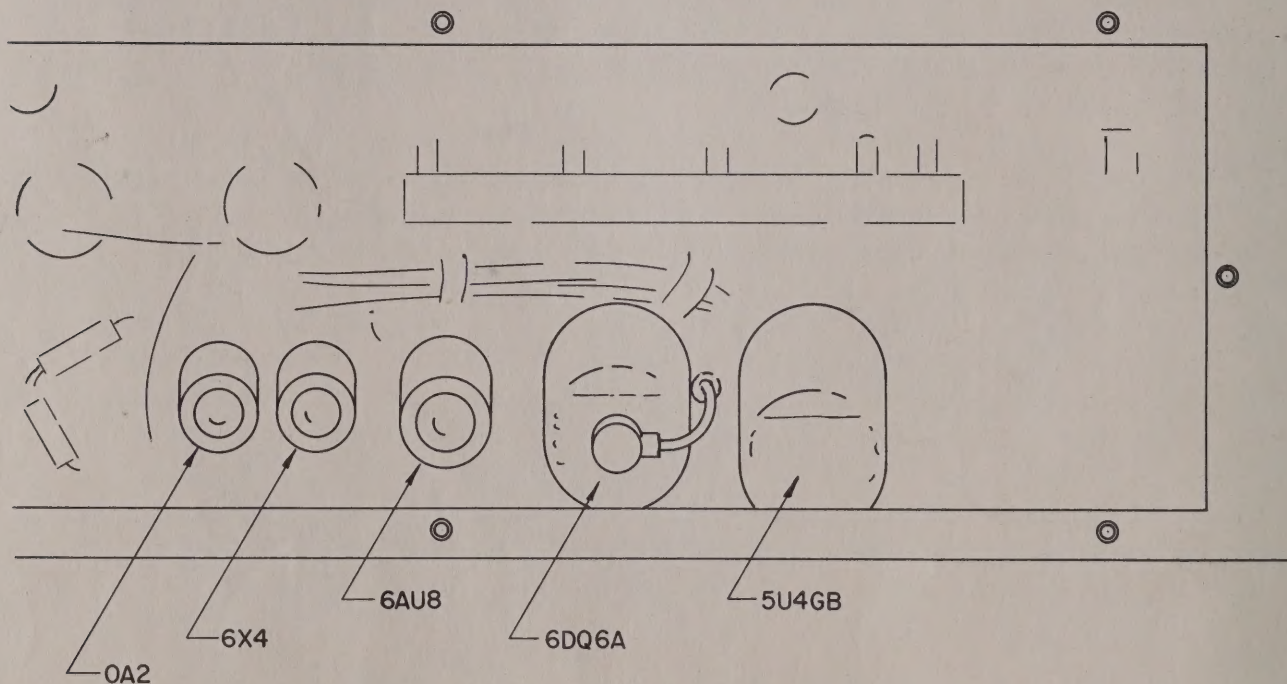


FIG. # 1

Fig. 1. TUBE LOCATIONS AS SEEN WITH THE BACK PANEL REMOVED

INSTALLATION (cont.)

4. Connect the line cord to 115 volt 60 cycle AC source. Be sure to connect the green pig tail, built into the line plug, to a suitable electrical ground, such as grounded electrical box or water pipe. This connection grounds the panel and case and is required by Underwriters for electronic equipment of this type.
5. Turn tester on by depressing the red button in the upper right hand corner. Allow tester to warm up.
6. Using the special set of "test cards", check the operation and calibration as described under the Maintenance Section.
7. After checking the Model 1230 with its test cards, the tester is ready for operation.

OPERATION:

Preliminary:

1. The Model 1230 must be connected to a proper source of power as outlined under the Installation Section.
2. Depress the red "ON" switch located in the upper right hand corner of the front panel. (Generally, the tube tester should be left on throughout the day, assuring instant operation when desired.) The instrument is now in a standby condition and prepared to perform testing operations as may be called for by the card system.

TUBE TESTING:

The green indicator lamp should be on before starting tube testing.

1. Select the card for the tube type to be tested.
2. Insert tube into socket indicated on card.
3. Insert card in slot of card switch -- push card until switch engages and black knob comes up.
4. Allow 10 - 15 seconds warm-up for tube under test.
5. Observe short lamps under hood below meter. If any bulbs glow, tube is shorted, replace.

TUBE TESTING (cont.)

NOTE: Disregard any bulb glow that occurs after #2 button has been released.

		If Needle is in	
		RED	GREEN
6.	Observe needle position on meter scale 1	Replace	OK
7.	Push button 2 and read scale 2	Replace	OK
8.	Push button 3 and read scale 3	Replace	OK
9.	GOLD printing on the card indicates one card is required to test the tube. RED printing denotes that two cards must be used for complete tests. GREEN printing denotes three and BLUE printing denotes four. Repeat test as above for each card.		

MAINTENANCE:

- A. The Model 1230 is checked and calibrated at the factory prior to shipment. However, it should be checked with its own test cards during installation and at appropriate intervals thereafter to assure proper operation.
- B. Test card checking and calibrating system:
 - 1. Special test cards are furnished for use by maintenance men or other authorized personnel in checking the tester. These cards are contained in an envelope inside the back cover of this instruction book.
- C. Test card check out procedure:

Turn tester on - allow 15 to 20 minutes warm up.

- 1. Insert card #1 in switch. Short lamps #1 and #5 should glow. Press #2 button. Meter should read half scale. If reading is other than half scale, adjust potentiometer #1. (See Figure #2) for proper location of controls.
- 2. Insert card #2. Short lamp #1 should glow. Press #2 button. Meter should read half scale. If other reading is obtained, adjust potentiometer #2.

MAINTENANCE (cont.)

3. Insert card #3, short lamp #1 should glow. Press #2 button. Adjust potentiometer #3 to obtain half scale reading on meter.
4. Insert card #4 (150 V supply). Short lamp #1 should glow. Press #2 button and adjust potentiometer #4 to obtain half scale reading on the meter.
5. ADJUSTMENT #5 IS SET AND SEALED AT THE FACTORY. NO. 5 CARD IS NOT FURNISHED.

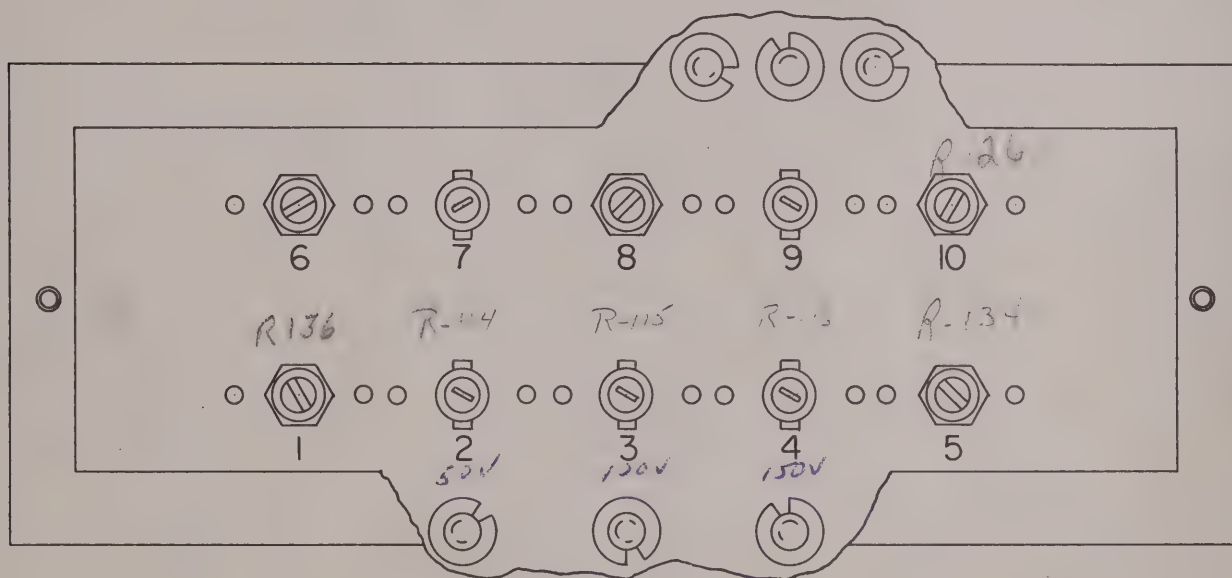


FIG.#2

Fig. 2. CALIBRATION CONTROLS AS SEEN WITH THE SIDE PANEL REMOVED.

MAINTENANCE (cont.)

6. Insert card #6. Press push button #2. The meter should indicate zero. If reading is off zero, adjust potentiometer #6 for correct indication.
7. Insert card #7. Press push button #2. The meter should indicate zero. Adjust potentiometer #7 for correct indication.
8. Adjustments #8, #9, and #10 are set and sealed at the factory.

If any of the above checks are not normal and cannot be adjusted properly follow the Trouble Shooting procedure. Should trouble still persist, contact the factory, giving the nature of the trouble. Instructions will then be given for either correcting the trouble or returning the equipment.

Address all service inquiries to THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 Dupont Avenue, Cleveland 8, Ohio

TROUBLE SHOOTING

SYMPTOM	PROCEDURE
Test 1 will not adjust properly.	Replace 6X4 and OA2 Tubes
Test 2 or 3, or 4 can not be adjusted for mid-scale reading.	Replace 6DQ6A, 6AU8 and 5U4GB. Be sure the plate cap is connected to 6DQ6A and the cap lead is not touching either the body of the 6DQ6A or the 5U4GB.
Test 6 or 7 cannot be adjusted.	Check 1/4 amp. fuse (See Service Note #4). Replace if necessary. If trouble persists, replace 1N91 crystals - Hickok Code #3870-39. (See Service Note #5).
No filament voltage to tubes under test.	Tighten or replace the 100 watt light bulb.
Card does not actuate the card switch when fully inserted.	First, check that the tester is turned on and card is being inserted properly, with printed side up. If trouble persists: TURN TESTER OFF! Move the card slowly back and forth in switch through last 1/4 inch of travel. An audible light "CLICK" of the micro switch should be heard. If <u>NO</u> "CLICK" is heard, readjust the micro switch as follows: Pull the line plug from the 115V A.C. power source. Remove the Phillips head screws on each side of the card switch cover. Lift the back of the cover, slide toward the front to clear the card guide and lift off. NOTE: The black reject knob must be down for cover to slide under the card guide.

TROUBLE SHOOTING

SYMPTOM	PROCEDURE
Card does not actuate the card switch when fully inserted.	Loosen slightly the two screws which secure the micro switch to its bracket at the top of the card switch. Carefully position the micro switch until the card actuates it as indicated by the "CLICK". Tighten the mounting screws. Recheck the action with a card. Plug tester into power source and turn on. Check that card now properly actuates switch. CAUTION: LINE VOLTAGE IS PRESENT ACROSS THE MICRO SWITCH CONNECTIONS. Be sure that the card releases easily when the reject knob is pushed. If it does not, the micro switch has been set in too close. Readjust slightly as described above until proper operation is achieved. Replace card switch cover. Be sure to pull line plug when making these mechanical adjustments as noted above.

TROUBLE SHOOTING

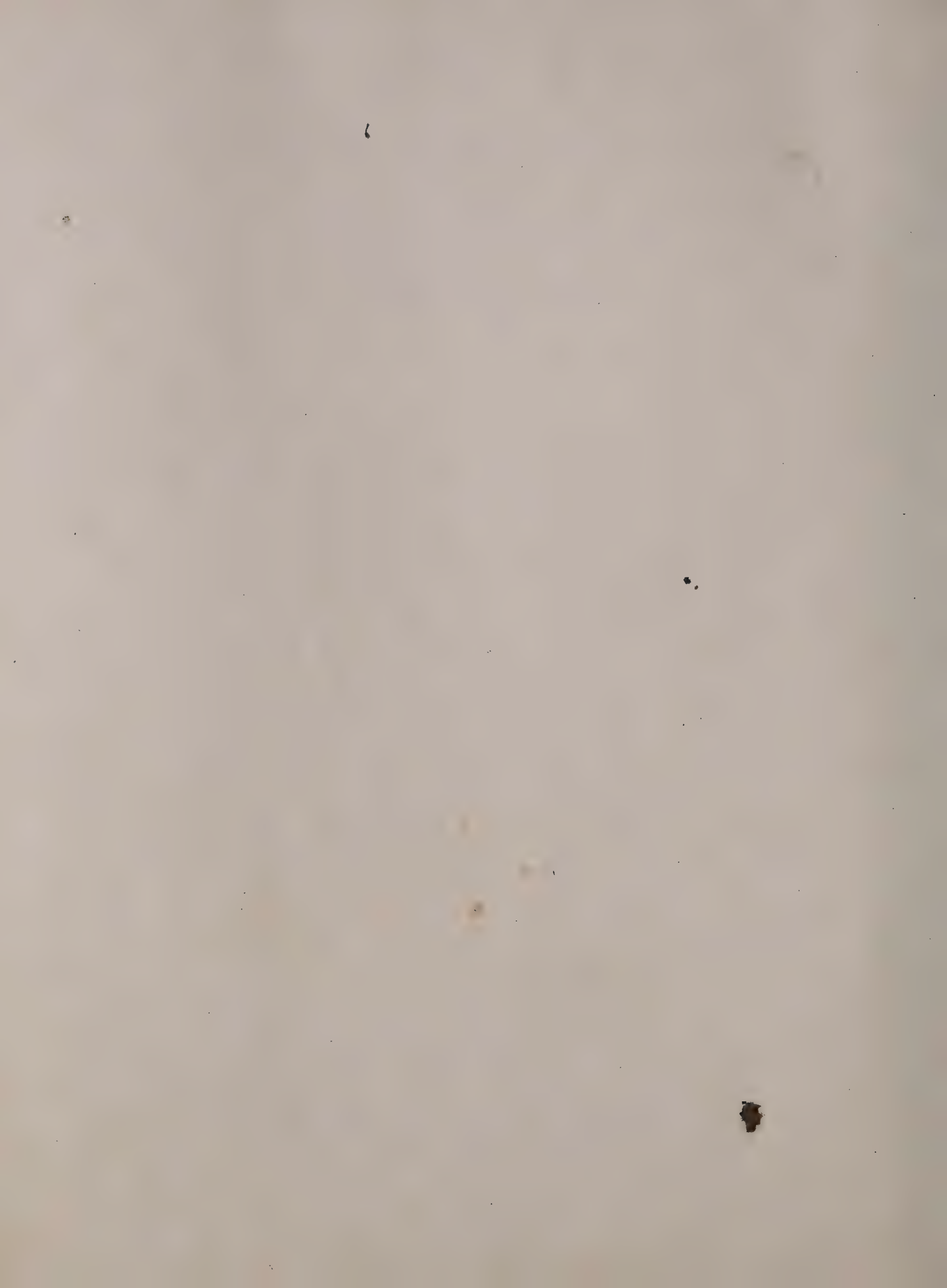
SYMPTOM	PROCEDURE
Card will not come out of switch when rejected.	Actuate switch with card and push reject knob again. If card still doesn't release, proceed as follows: Pull the line plug from the 115V A. C. power source. Remove the Phillips head screws on each side of the card switch cover. Lift the back of the cover, slide toward the front to clear the card guide and lift off. NOTE: The black reject knob must be down for cover to slide under the card guide. Inspect the tops of the contact pins as seen through the holes. One of these pins has moved up above its normal position through a hole in the card. Using a small screw driver, or other suitable tool, carefully push the pin down until it clears the card. The card should now slide easily out of the switch. Plug tester into power source and turn ON. Re-activate the switch several times with the same card. The card should be free to slide out each time the reject button is pushed. When operation is normal, replace card switch cover.

SERVICE NOTES
FOR
MODEL 123, 123A AND 1230
CARDMATIC TUBE TESTERS

The following notes and procedures generally pertain to servicing which can be accomplished in the field. Should trouble persist, contact the factory, giving nature of trouble. Instructions will then be given for correcting the trouble or returning the equipment.

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HICKOK ELECTRICAL INSTRUMENT COMPANY
10514 Dupont Avenue - Cleveland 8, Ohio



SERVICE NOTE NO. 1

Calibration Potentiometer Adjustments

1. Potentiometers #5 and #10 set the signal amplitude and signal voltage regulation.
 - a. Connect the instrument to the line thru a Variac set to 115 Volts. Turn instrument on.
 - b. Insert a 6L6 card in switch.
 - c. Connect a high impedance, sensitive AC voltmeter from pin 5 to pin 8 on any convenient one of the tube test sockets. (See Figure #1).

NOTE: THIS MUST BE A HIGH IMPEDANCE AC VOLTMETER CAPABLE OF ACCURATE MEASUREMENT OF 0.22 VOLTS AC. BALLANTINE MODEL 300 OR EQUIVALENT IS RECOMMENDED.

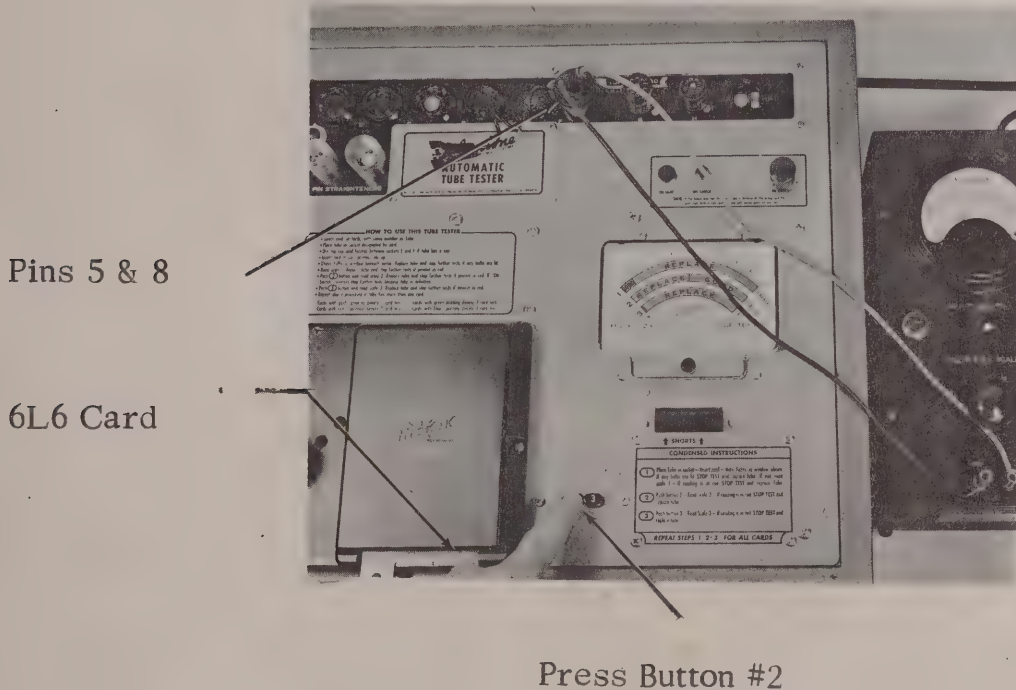


Figure 1
Signal Regulation and Amplitude Test Arrangement

- d. Check voltage regulation as follows:
While holding down button #2, vary the line voltage from 105 to 125 volts. Note the reading indicated on the voltmeter. The signal voltage at 105 and 125 should be the same. The signal voltage at 115 should not vary over 1% from the 105 and 125 readings.
If the circuit is not regulating in this manner, adjust potentiometer #10 and rock the line voltage until the desired regulation is indicated on the voltmeter. The exact value of the signal voltage during this regulation adjustment is not critical.

e. After the signal regulation is properly adjusted, the exact signal level of 0.22 volts r. m. s. is set by adjusting potentiometer #5.

2. Calibration of potentiometer #8

This control adjusts the cut-out level of the high sensitivity coil of the overload relay. It is adjusted as follows:

a. Insert test card number 4 in card switch. Place a short circuit from pin 3 to pin 6 on any convenient tube test socket. See Figure #2. Adjust potentiometer #8 until the overload relay kicks out when button #2 is pushed. When adjustment is complete remove short circuit.

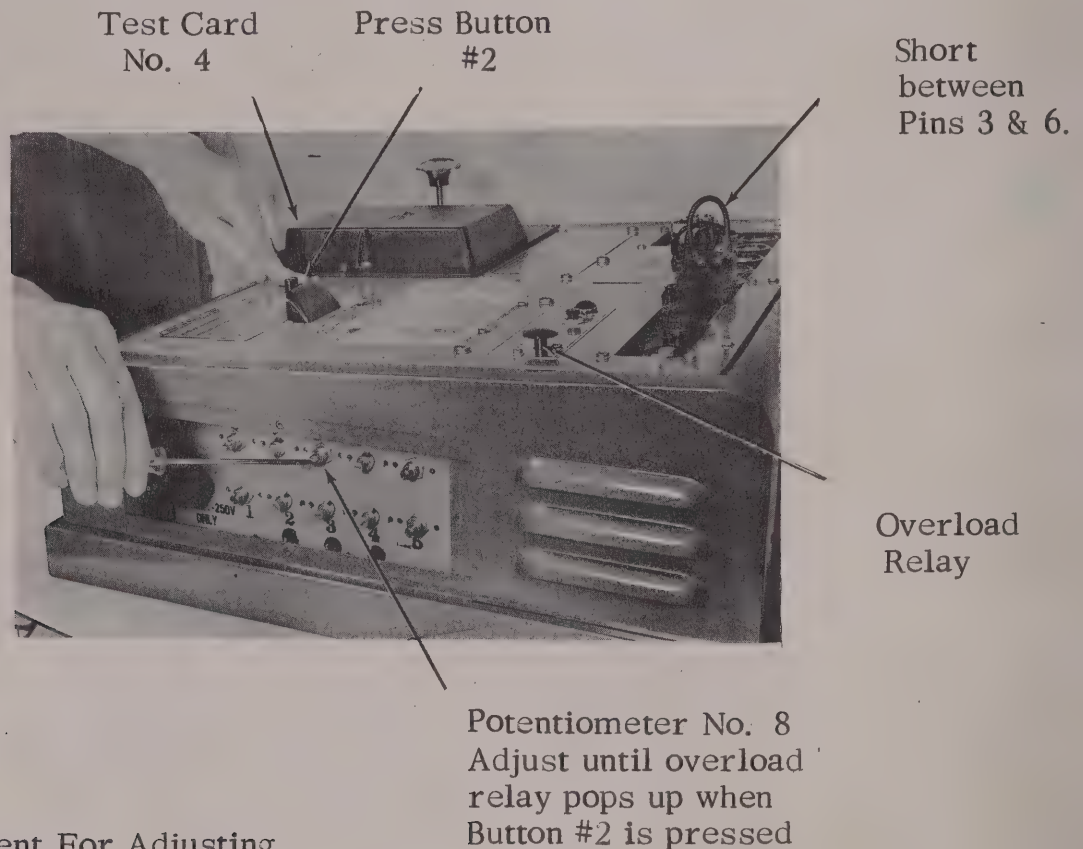


Figure 2
Test Arrangement For Adjusting
Potentiometer No. 8

3. Adjustment of potentiometer #9

This control adjusts short test sensitivity. The procedure is as follows:

a. Turn tester on.

b. Insert 12BY7 card in card switch.

c. Connect a 10 megohm resistor from pin 1 to pin 2 on any convenient tube test socket. (See Figure #3.)

d. Adjust potentiometer #9 until neon short lamps 1 through 4 just flicker on and off. Lamp 5 will not flicker.

e. Connect a 20 megohm resistor in place of the 10 megohm used above. All lamps should be completely out. If glow is observed repeat the last two steps.

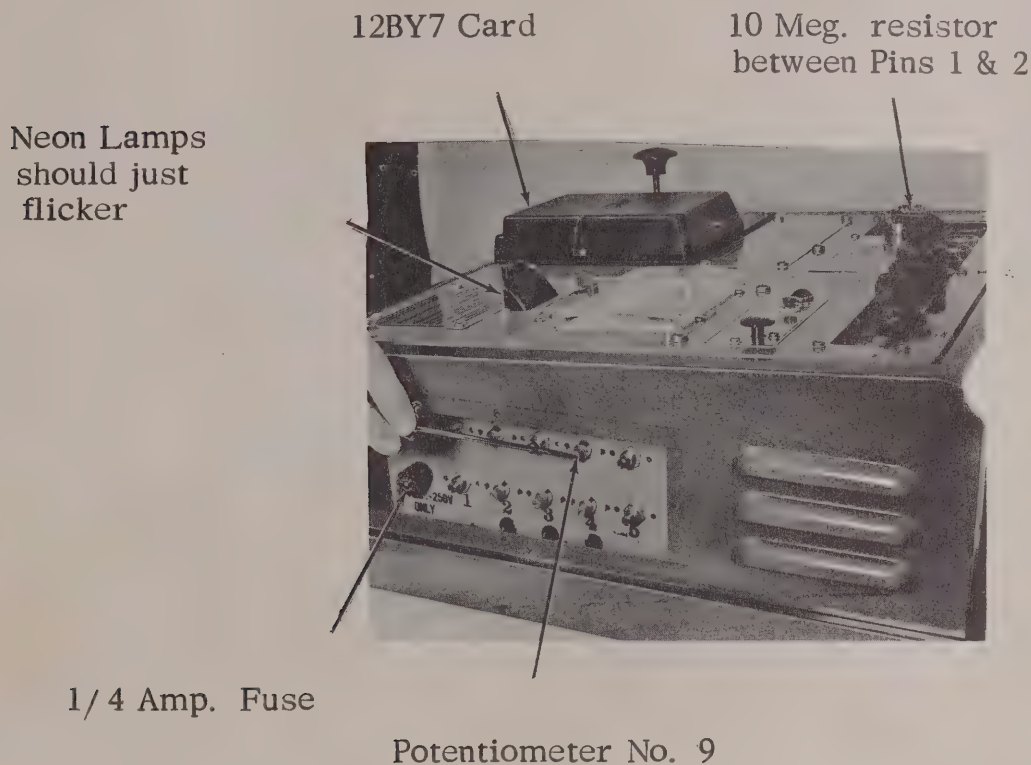


Figure 3

Test Arrangement for Adjusting Short Test Sensitivity Potentiometer No. 9

SERVICE NOTE NO. 2

Checking B+ Voltages

The regulated B+ voltages are normally checked on the instrument by use of test cards #2 (50 volt supply), #3 (100 volt supply) and #4 (150 volt supply).

If one or more of these tests does not give a mid-scale reading on the panel voltmeter and the associated potentiometer cannot be adjusted, the source of trouble may be isolated as follows: (See Figure #4)

Connect an external voltmeter from pin #3 to pin #6 on one of the tube test sockets (any one of the test sockets may be used according to convenience).

If the external voltmeter agrees with the panel meter that the power supply cannot be adjusted, then the trouble lies in the power supply itself. Check power supply tubes, and appropriate power supply socket voltages. (See Service Note #6).

If the external meter shows the power supply to be properly adjusted while the panel meter shows an appreciable error, then the trouble lies in the meter or shunting system.

Use Shunt resistor test cards to check metering system (See Service Note #8).

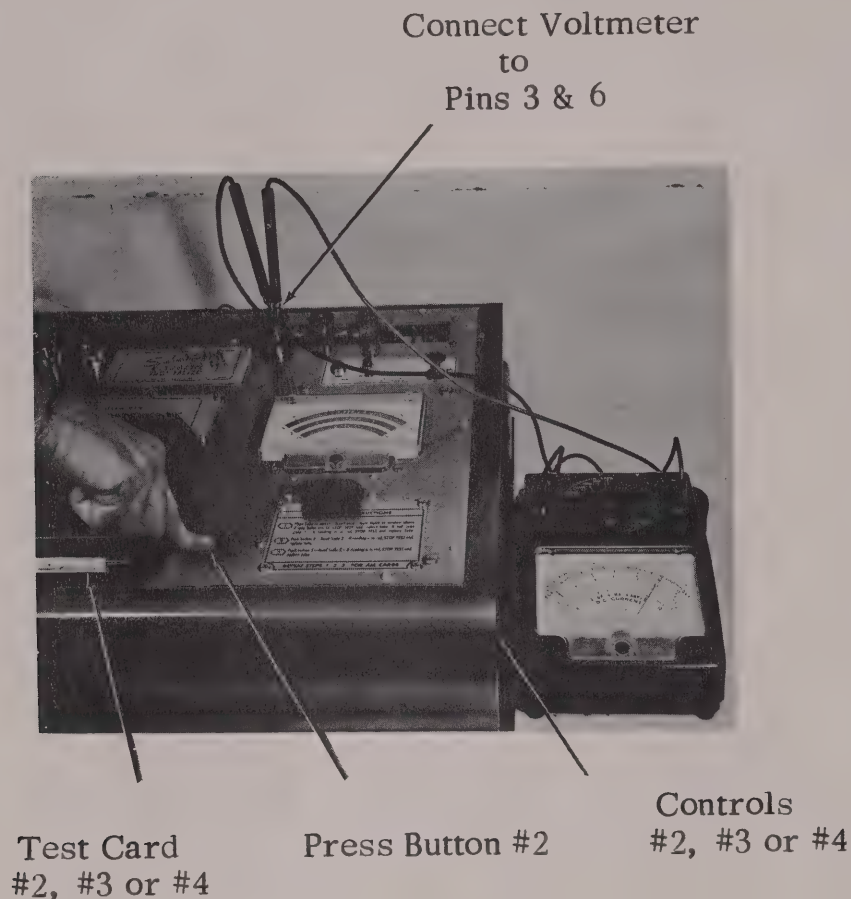


Figure 4
Checking B+ Voltages with an External Voltmeter.

SERVICE NOTE NO. 3

Tolerances on Tests #6 and #7.

Test cards 6 and 7 are used to zero balance the Gm bridge circuit at high current levels and low current levels respectively. These controls require occasional checking and adjustment to assure maximum accuracy in Gm readings. However, a certain amount of drift from zero is permissible without introducing appreciable errors.

During these calibration tests the meter has a high sensitivity. On test #7 a drift of 10 meter divisions from zero is equivalent to 50 micro-mhos. This would represent only a 1% error on a typical 5000 micro-mho tube reading.

If very accurate readings are desired on the low Gm tubes (500 to 1000 Gm) it would be advisable to check the zero balance calibration just before the tests are made. However, in general testing this procedure is not necessary.

In actual practice it is usually best to adjust these controls in reverse order. In other words, check and adjust potentiometer #7 first, then adjust potentiometer #6.

SERVICE NOTE NO. 4

Fuse Protection for Gm Bridge

A 1/4 amp fuse is mounted in a fuse holder mounted next to potentiometer #6. (See figure #3). This fuse should be checked first in case of difficulty on test cards 6 and 7. If defective, replace with type 3AG, 1/4 amp fuse, only DO NOT USE "SLOW BLOW" type fuse.

SERVICE NOTE NO. 5

Replacing 1N91 diodes

If it becomes necessary to replace the 1N91 diodes mounted on the module board the following points should be kept in mind.

1. The crystals supplied in the original equipment are matched units. They are either two matched pairs or all four are matched together. Replacements should also be matched units. These are available under Hickok part Code No. 3870-39.

2. When replacement is made the crystals must be physically mounted in the same manner as the ones that are removed. This arrangement is shown on the Printed Circuit Board Component Layout sheet, Fig. #5.

3. Care should be taken not to overheat the crystal during the soldering operation. It is suggested that the lead wire be held with pliers between the crystal body and the point being soldered (THIS IS VERY IMPORTANT!)

SERVICE NOTE NO. 6

Power supply tube socket voltage chart

The following chart indicates the nominal voltages present on the pins of the power supply tubes during checks with test cards 2, 3, and 4. These voltages should be read with a 20,000 ohms/volt voltmeter and are all referred to pin #1 of the OA2 socket as zero potential for "Ground". The chassis of this instrument is not electrical ground. Input voltage to the instrument should be 115 VAC.

SOCKET CONTACTS

Tube	Test Card	1	2	3	4	5	6	7	8	9
OA2	2	0	- 145	NC	NC	NC	NC	- 145		
	3	0	- 145	NC	NC	NC	NC	- 145		
	4	0	- 145	NC	NC	NC	NC	- 145		
6X4	2	215 AC	NC	HTR	HTR	50	215AC	101		
	3	215 AC	NC	HTR	HTR	50	215AC	101		
	4	215 AC	NC	HTR	HTR	52 * 50	215AC	103 101*		
6AU8	2	0	-1.05	145	HTR	HTR	0	* -4.2	* 180	* 76
	3	0	-1.05	145	HTR	HTR	0	-2.1	145	69 35
	4	0	-1.05 *-1.03	145	HTR	HTR	0	-5.5	210 *195	100 140*
6DQ6	2	-1.05	HTR	-34 *27	345 *340	-170 *-135	NC	HTR	52	
	3	-1.05	HTR	+35 *43	345 *335	+ 35 *+ 44	NC	HTR	102	
		-1.05 *-1.25	HTR	+102 *140	345 *275	+102 *+140	NC	HTR	150	
5U4	2	NC	FIL	59	250AC	0	250AC	365AC *360	FIL	
	3	NC	FIL	59	250AC	0	250AC	362AC *352	FIL	
	4	NC	FIL	59 *57	250AC *245	0	250AC *245	360AC *290	FIL	

All readings taken with a
20,000 ohms per volt meter

Voltages at socket contacts (Power Supply)
with zero volts as reference point.

Pin #1 of OA2 socket = Zero
Input = 115 Volts

*Button 2 pressed

PRINTED CIRCUIT BOARD COMPONENT LAYOUT

RUBBER SHORT LAMP HOLDER

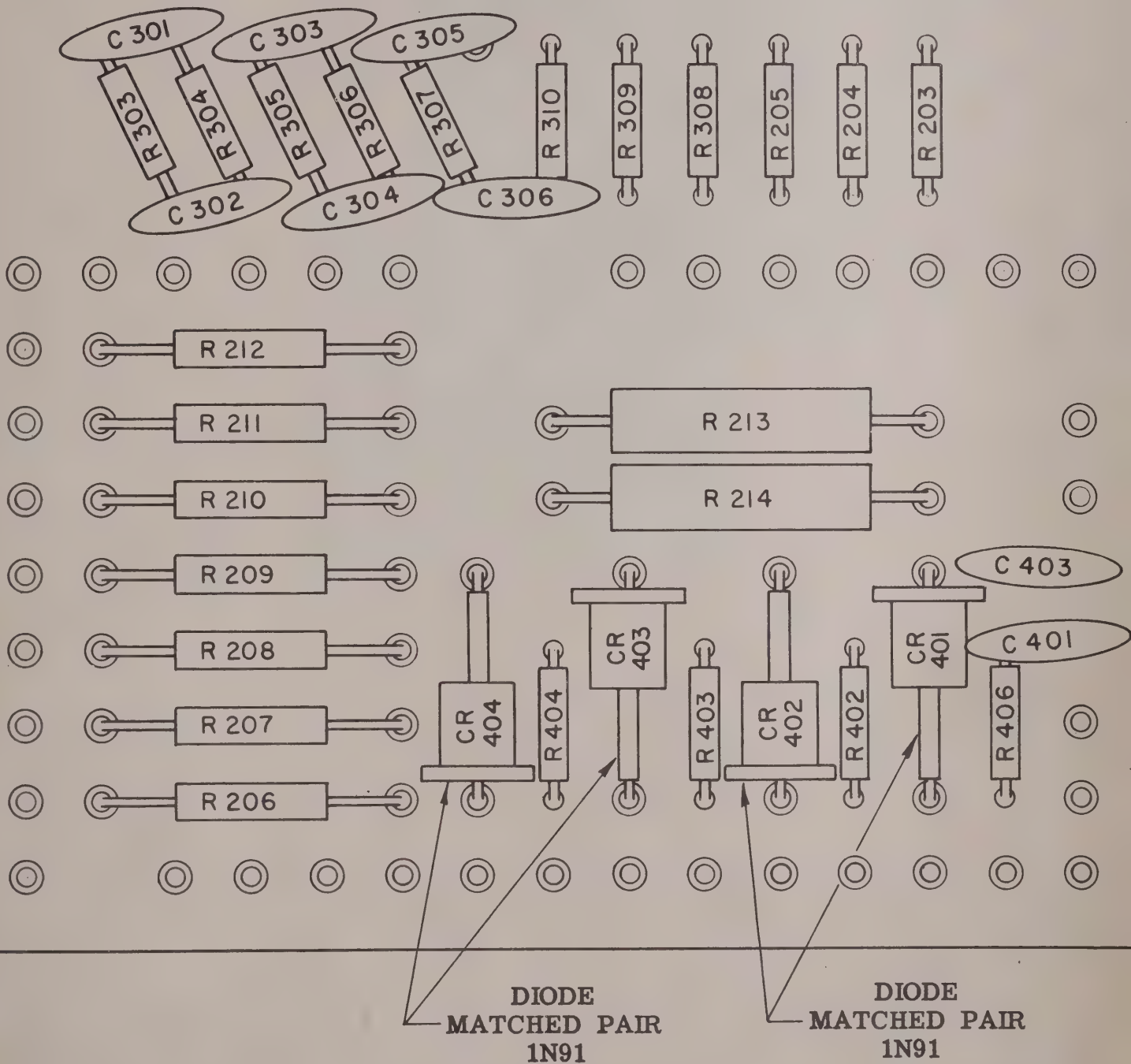


Figure 5

SERVICE NOTE No. 7

Overload Relay - Checking and Adjustment

1. Preliminary checks

a. Carefully remove tester from case.

b. Determine that the relay coils are not open by checking between terminals 1 and 3 for approximately 100 ohms resistance and terminals 2 and 3 for ~~0.5~~ ohms resistance. (See Fig. #6: Terminals to be Counted from Top - down). 11

If either winding is open a new relay may be obtained from the factory, Hickok Part Code No. 18400-6.

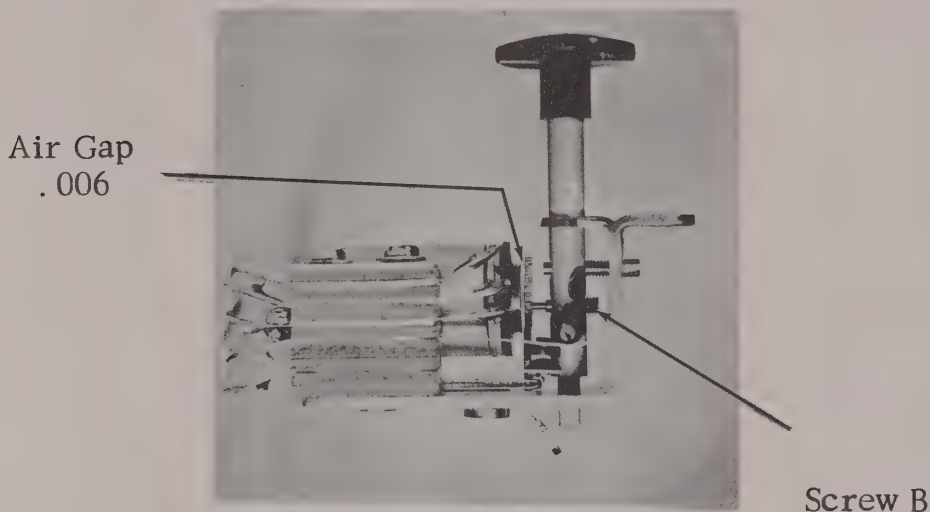


Figure 6
Relay Shown In "up" Position

The mechanical and electrical adjustments described below are intended to be performed without removing the relay from the instrument. The procedure is substantially the same to check a relay outside the equipment, if desired.

2. Mechanical Adjustment

a. With the relay up, check that the air gap is set to .006 inches by use of proper feeler gages. (See Fig. #6) Air gap can be reset by adjusting lower screw "B". The glyptal sealing the adjusting screw should be softened with thinner before resetting. The screw should be resealed with glyptal after adjustment.

b. With the relay in the down (engaged) position, check that the end of the lower screw "B", is in line with the inside edge of the armature. Any required adjustment is accomplished with the upper screw "A". Soften glyptal with thinner before adjustment and reseal with glyptal after adjustment as before. (See Fig. #7).

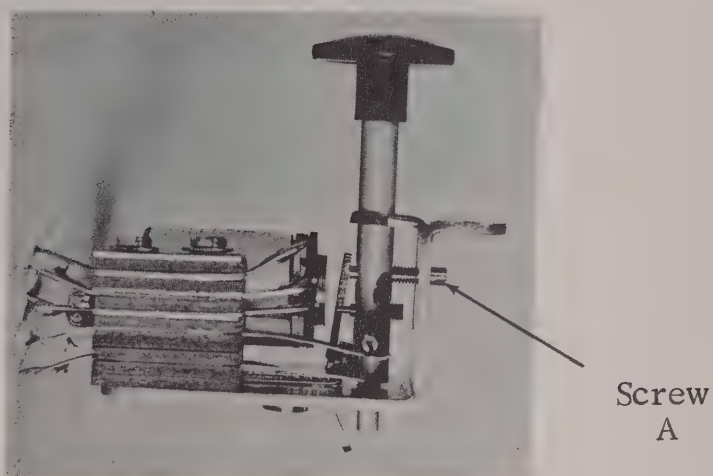


Figure 7
Relay In Down (Engaged) Position

3. Electrical Adjustment

a. Connect a temporary short circuit between the two terminals as indicated in Fig. #8.

b. Connect the line cord in series with a 0-5 amp. AC ammeter to a variable source of low voltage AC. (See Fig. #8). This source can be a variac or preferably a variac in the primary of a step down transformer. A filament transformer is suitable for this purpose.

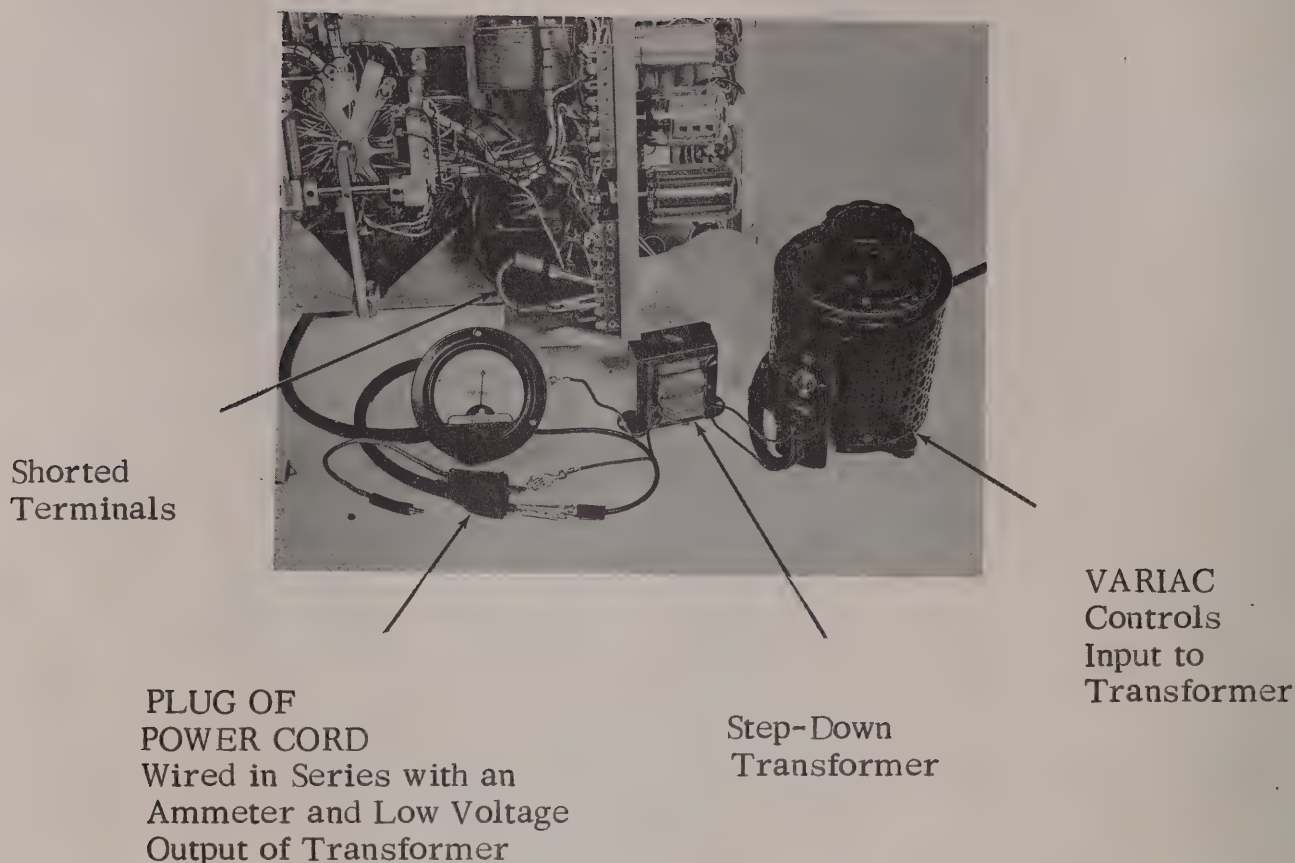


Figure 8
Test Circuit for Electrical Adjustment of the Relay

- c. Slowly increase the current to the tube tester by raising the output voltage from the variac. The overload relay should "kick out" between 3.0 and 3.2 amps. AC.
- d. If the relay kicks out below 3.0 amps AC, increase the tension on the spring by turning lug "C", figure #9. Recheck and readjust spring tension until relay kicks out within proper limits.
- e. If the relay kicks out above 3.2 amps AC, decrease tension on the spring by turning the lug until desired setting is reached.
- f. Be sure to lock spring adjustment with glyptol after resetting.

Adjust
Spring Tension
by turning Lug "C"

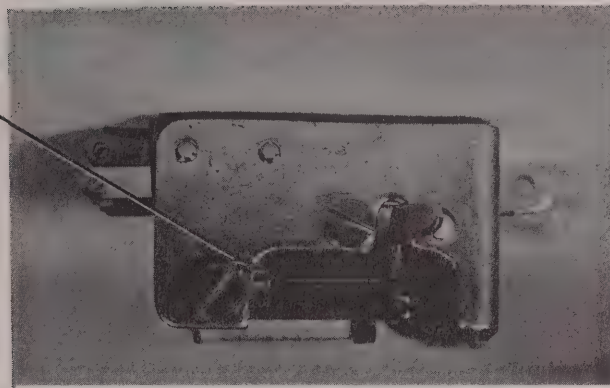


Figure 9
Bottom View of Relay Showing Spring Adjustment

SERVICE NOTE NO. 8

Meter Shunt Test Cards

Eight special meter shunt test cards are enclosed with this manual. These cards are intended to facilitate the location of possible defective meter shunt resistors. Each card checks one meter shunt resistor. The normal readings while pushing button 2 should be approximately mid-scale on the meter. If the shunt resistor is open or shorted, the meter will read toward zero or almost full scale and that resistor should be replaced. Latest model instruments have a 0-100 scale on the meter dial. A meter reading between 45 and 55 with any of these cards is satisfactory.

The shunt resistor test cards are identified as A, B, C, D, E, F, G, and H.

Replacement shunt resistors may be obtained from the factory under the following code numbers which are listed in their proper relationship to their test card.

<u>Test Card</u>	<u>Resistor Value</u>	<u>Replacement Resistor Code No.</u>
A	1280 ohms $\pm$ 1%	18537 - 72
B	640 ohms $\pm$ 1%	18537 - 71
C	320 ohms $\pm$ 1%	18537 - 70
D	160 ohms $\pm$ 1%	18537 - 31
E	80 ohms $\pm$ 1%	18537 - 69
F	40 ohms $\pm$ 1%	18537 - 68
G	20 ohms $\pm$ 1%	18673 - 207
H	10 ohms $\pm$ 1%	18673 - 205

The location of these resistors is shown on figure #5.

		<u>Resistor Value</u>
A	R-207	1280 ohms $\pm$ 1%
B	R-208	640 ohms $\pm$ 1%
C	R-209	320 ohms $\pm$ 1%
D	R-210	160 ohms $\pm$ 1%
E	R-211	80 ohms $\pm$ 1%
F	R-212	40 ohms $\pm$ 1%
G	R-213	20 ohms $\pm$ 1%
H	R-214	10 ohms $\pm$ 1%

REPLACEMENT PARTS LIST

The following is a list of parts which can be replaced in the field and a list of their corresponding Hickok part numbers.

<u>Hickok Part Number</u>	<u>Description</u>	<u>Comments</u>
3085-77	Capacitor: electrolytic, 20-20-20-20 mfd. 450V, 1-3/8 x 3", supplied with in- sulating sleeve	
3085-78	Capacitor: electrolytic, 20-20 mfd, 450V, 1" x 3" supplied with insulating sleeve	
3085-79	Capacitor: electrolytic, 1000 mfd, 40 volts 1-3/8 x 3" supplied with insulating sleeve	
3085-80	Capacitor: electrolytic, 1000 mfd, 6 volts 1" x 3" supplied with insulating sleeve	
3105-209	Capacitor: plastic, tubular, 0.1 mfd, 400V, Astron Blue Point	
3105-226	Capacitor: paper, 4 mfd, 600 volts Astron supplied in 2 lug can.	
3105-218	Capacitor: Plastic, tubular, 0.25 mfd., 400V, Astron Blue Point	

REPLACEMENT PARTS LIST

<u>Hickok Part Number</u>	<u>Description</u>	<u>Comments</u>
3110-7	Capacitor: Ceramic, .005 mfd, disc type, Centralab type DA-048-001A (-0+100%) Centralab Distributor Part No. DD501	Symbol Numbers - C-302, C303, C-304, C-305, C-306, C-401, C-403
3250-72	Choke: Power, 4 henrys at 100 mils	
3870-39	Crystal: paired IN91	
12270-35	Lamp: GE #47, 6-8V, .15 amp	Aged at factory
12270-22	Lamp: GE #51 Pilot	
12270-26	Lamp: NE-2 neon	Aged at factory
16925-222	Potentiometer: 1000 ohms, linear, taper, 1/2 watt, Centralab model #2, snap- in type	Low current balance Control #7
16925-244	Potentiometer: 10,000 ohms, 2 watt, wire wound, Chicago Telephone type 252	Bias adjust Control #1 Relay sensitivity control #8
16925-287	Potentiometer: 500 ohms, 2 watt, wire wound, Chicago Telephone type 252	Signal Regulation Control #10
16925-288	Potentiometer: 2 ohms, 2 watt, wire wound, Chicago Telephone type 252	High current balance Control #6
16925-289	Potentiometer: 50 ohms, 2 watt, wire wound, Chicago Telephone type 252	Signal amplitude Control #5
16925-290	Potentiometer: 1 megohm, $\pm 20\%$, 1/2 watt carbon, linear taper, Centralab Model 2, snap-in type	B+ voltage controls #2, 3, 4, and Cen- tralab Distributor Part No. BX69

REPLACEMENT PARTS LIST

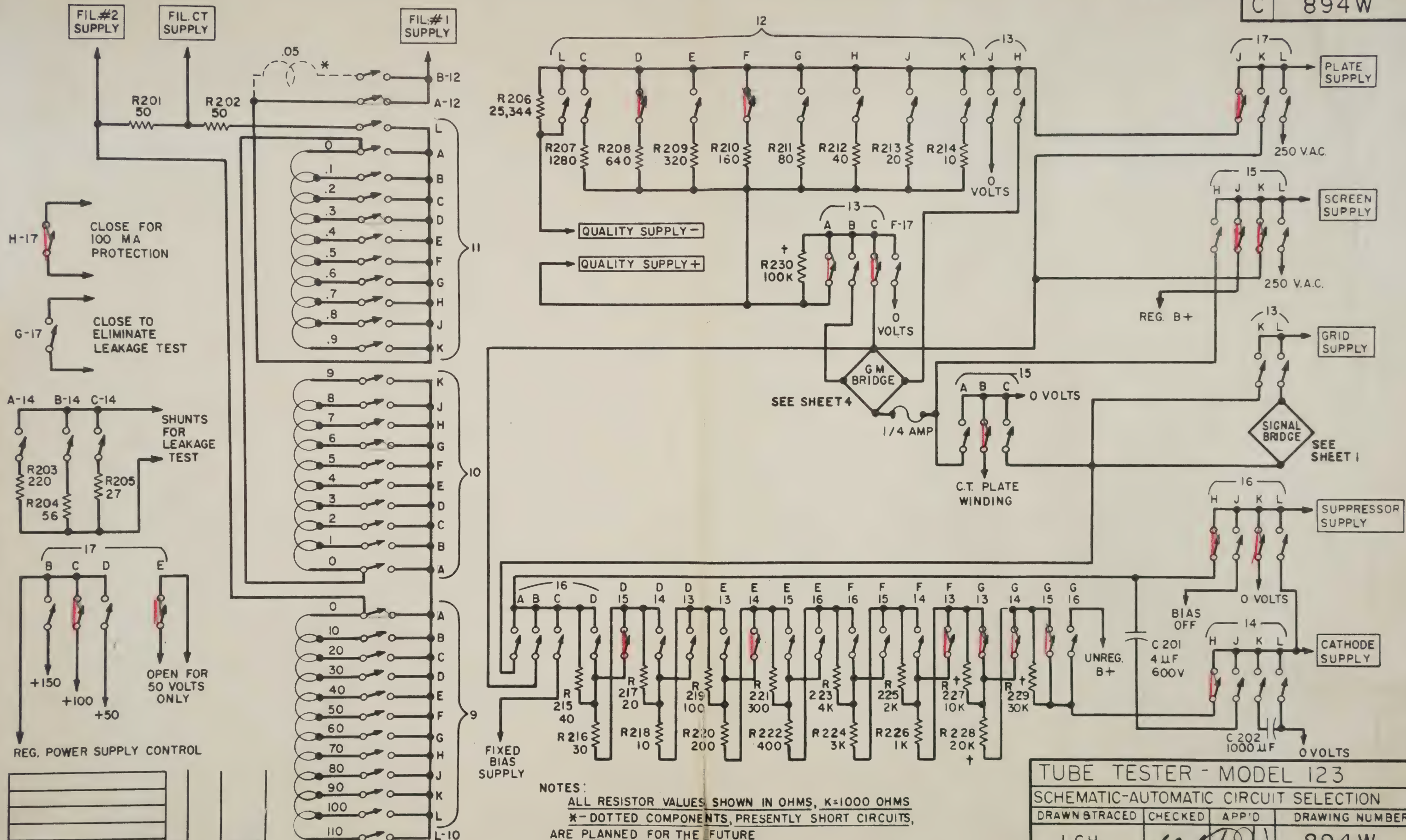
<u>Hickok Part Number</u>	<u>Description</u>	<u>Comments</u>
18537-72	Resistor: Deposited Carbon, 1280 $\Omega \pm 1\%$ 1/2 watt	Shunt A (R-207)
✓ 18537-71	Resistor: Deposited Carbon, 640 $\Omega \pm 1\%$ 1/2 watt	Shunt B (R-208)
18537-70	Resistor: Deposited Carbon, 320 $\Omega, \pm 1\%$ 1/2 watt	Shunt C (R-209)
✓ 18537-31	Resistor: Deposited Carbon, 160 $\Omega \pm 1\%$ 1/2 watt	Shunt D (R-210)
18537-69	Resistor: Deposited Carbon, 80 $\Omega \pm 1\%$ 1/2 watt	Shunt E (R-211)
18537-68	Resistor: Deposited Carbon, 40 $\Omega \pm 1\%$, 1/2 watt	Shunt F (R-212)
18673-207	Resistor: Deposited Carbon, 20 $\Omega \pm 1\%$, 1 watt	Shunt G (R-213)
18673-205	Resistor: Deposited Carbon, 10 $\Omega \pm 1\%$, 1 watt	Shunt H (R-214)

NOTE ON SCHEMATIC DIAGRAM

THE MODEL 1230 IS ELECTRICALLY EQUIVALENT
TO THE MODEL 123 A. ALL NOTATIONS ON THE
SCHEMATIC DIAGRAM REFERRING TO THE MODEL
123 OR 123A ARE APPLICABLE TO THE MODEL 1230.

NOTE ON SCHEMATIC DIAGRAM

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TUBE TESTER - MODEL 123

SCHEMATIC-AUTOMATIC CIRCUIT SELECTION

DRAWN & TRACED CHECKED APP'D. DRAWING NUMBER

LCH

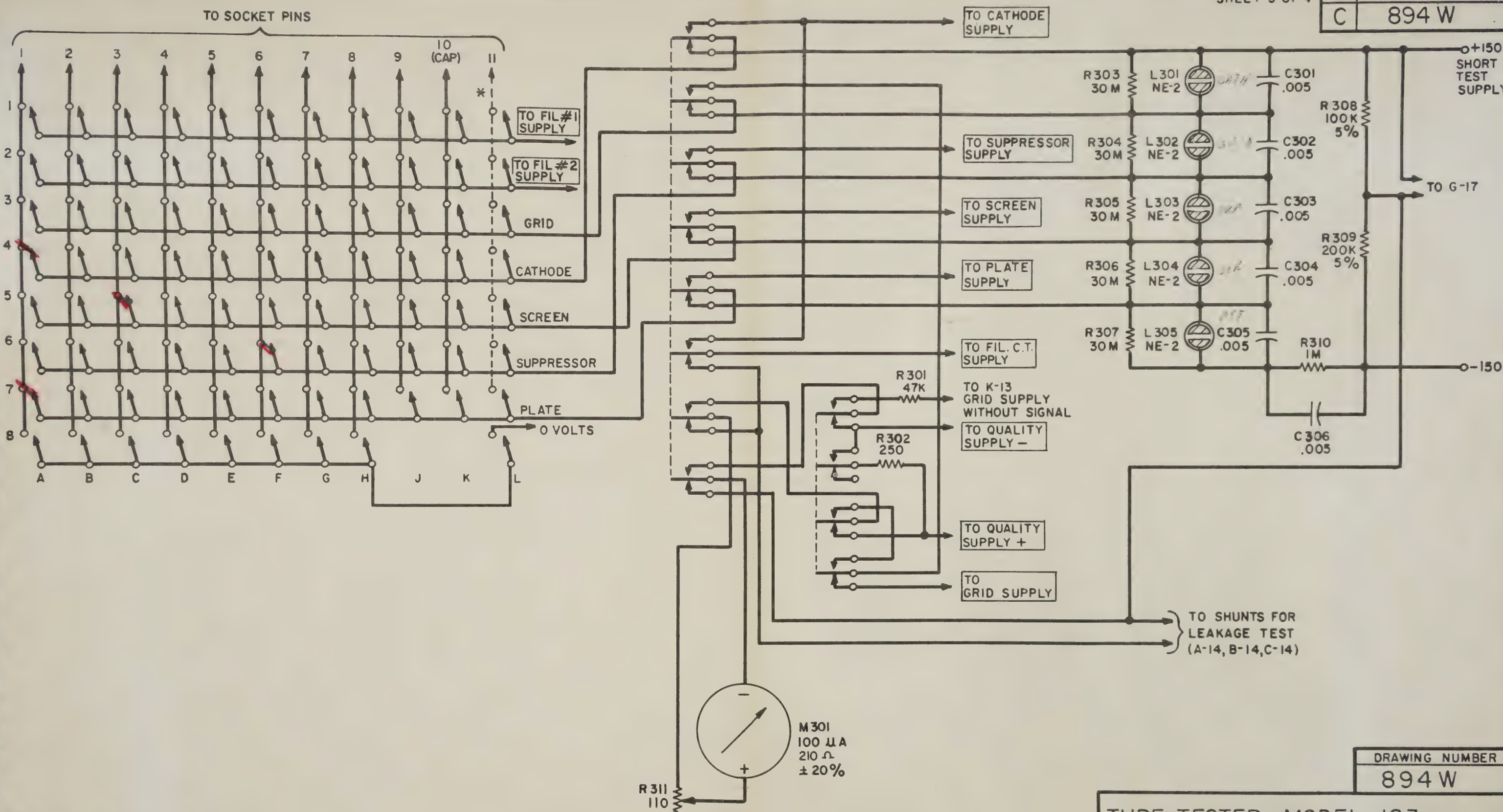
894W

THE HICKOK ELECTRICAL INSTRUMENT CO.

CLEVELAND, OHIO

DATE: 8-20-56

C	18092, 18131	RB	7-29-57
B	17738-17740	LD	4-2-57
A	17285	PK	11-29-56
NO.	ALTERATION	BY	APP'D. DATE



NOTE:

RESISTOR VALUES SHOWN IN OHMS - M=MEGOHMS - K=1000 OHMS.

CAPACITOR VALUES SHOWN IN MICROFARADS.

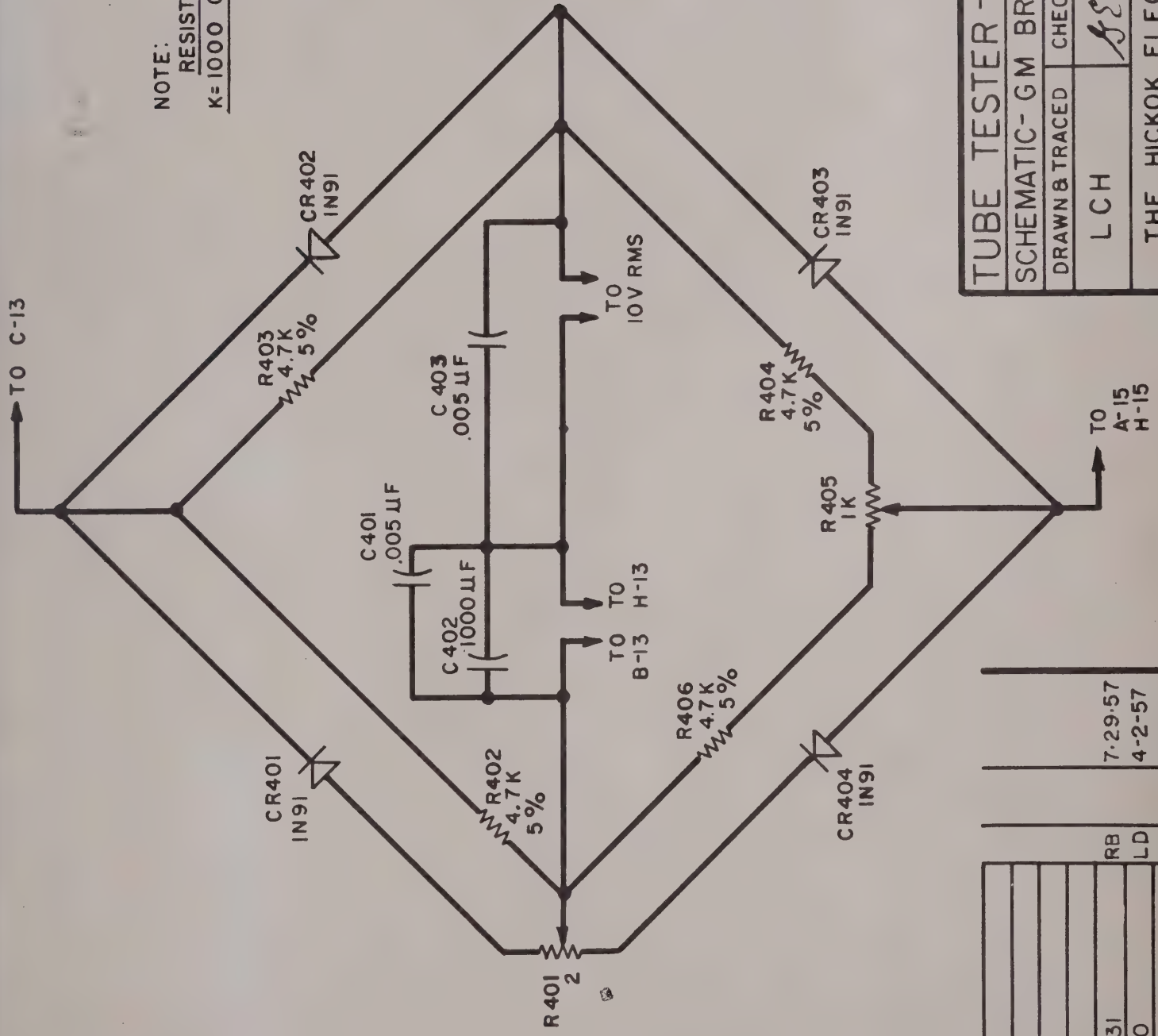
* - DOTTED LINE INDICATES FUTURE CONNECTIONS.

TUBE TESTER - MODEL 123			
SCHEMATIC-AUTOMATIC PIN SELECTION			
DRAWN & TRACED	CHECKED	APP'D	DATE
LCH	<i>[Signature]</i>		8-31-56
THE HICKOK ELECTRICAL INSTRUMENT CO. CLEVELAND, OHIO			

NO.	ALTERATION	BY	APP'D	DATE
C	18092, 18131	RB		7-29-57
B	17738-17740	LD		4-2-57
A	17285	PK		11-29-57

NOTE:

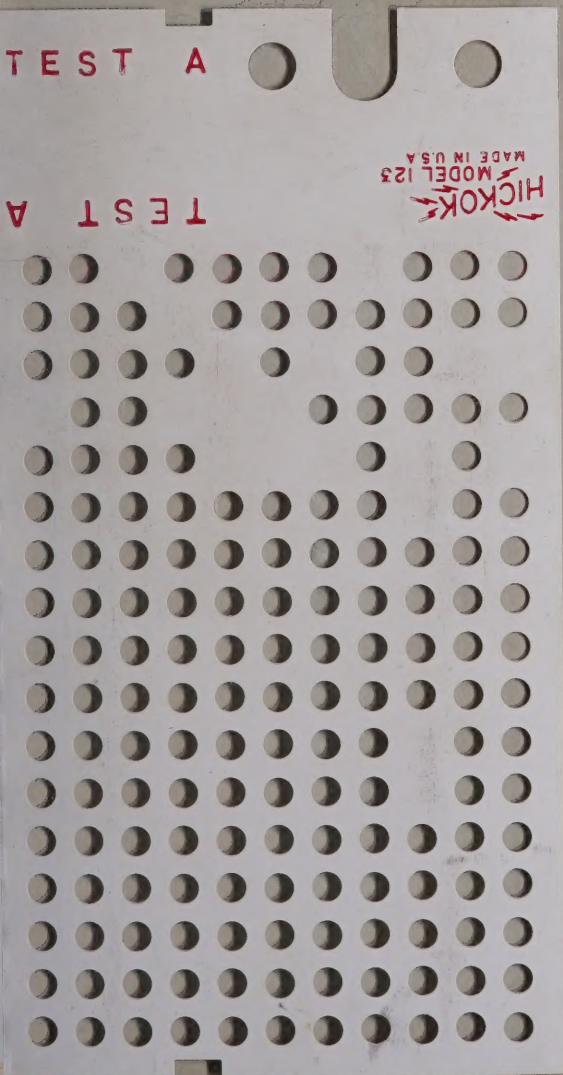
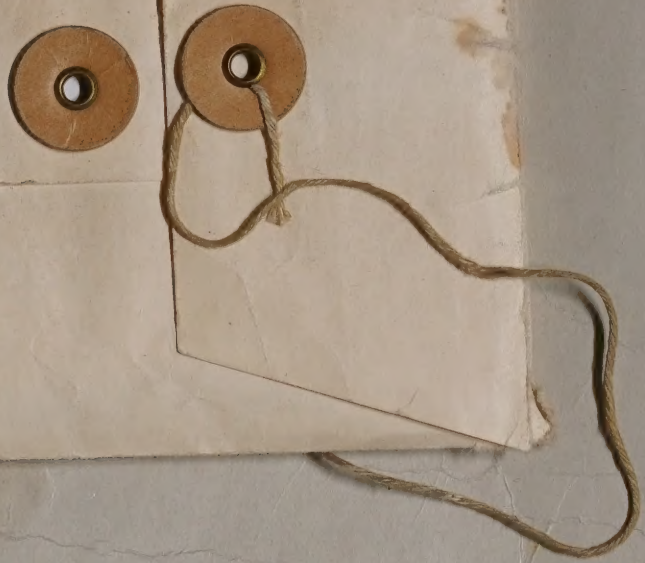
RESISTOR VALUES SHOWN IN OHMS,
K=1000 OHMS.



TUBE TESTER - MODEL 123			
SCHEMATIC - GM BRIDGE			
DRAWN & TRACED	CHECKED	APP'D.	DATE
LCH	<i>SES</i>	<i>LDW</i>	9-4-56
THE HICKOK ELECTRICAL INSTRUMENT CO. CLEVELAND, OHIO			

NO.	ALTERATION	BY	APP'D	DATE
C	18092 - 18131	RB		7-29-57
B	17738-17740	LD		4-2-57
A	17285	PK		11-29-57

TEST CARDS





-25 pin 3
+115 pin 5
+175 pin 8